



PENN VET WORKING DOG CENTER

Challenge

Better allocate resources within training programs by more quickly identifying those dogs with an aptitude for working dog roles from those who lack the drive and focus for work and may not be the best fit for the job.

Who's a good dog? A statistical approach helps researchers put well-behaved canines to work.

K9 working dogs patrol public spaces, detect drugs and bombs and aid in search and rescue. But training can be costly and time-consuming. By analyzing behavioral trends indicative of success, researchers may better predict which dogs will be best suited to which tasks.

K9 working dogs play a key role in making our public spaces safer, from patrolling for contraband narcotics and uncovering explosives to rescuing missing persons and disaster victims. In many situations, a dog's effectiveness can mean the difference between life and death. That effectiveness is cultivated from an early age as puppies undergo rigorous behavioral and skills training.

But how do trainers decide which dog will be best suited to which purpose – or which dogs will perform most successfully in real-world situations? These questions are at the heart of training programs across the country, where trainers make a significant time and financial investment in each dog they bring up through the program.

To more effectively identify those dogs with a penchant for work or service, researchers are now turning to behavioral testing as a source of insight. By applying behavioral analysis to a range of performance indicators, researchers can determine which behaviors are associated with long-term career success. Puppies can then be tracked into different careers depending on their early behavior.

While this sorting game long relied more on trainers' gut feeling about a particular dog than on algorithms, statistical approaches are now enabling them to make more data-driven decisions about which dogs are groomed for which tasks. One researcher working on this problem is Jordan Gillespie, a current PhD student in the Comparative Cognition Lab at Auburn University in Alabama.

Good boys and bad lads

Gillespie's work looks at an archive of behavioral tests conducted by the Penn Vet Working Dog Center at the University of Pennsylvania Veterinary School of Medicine. Data in this archive represent evaluation for toy engagement, toy hunting and stress behaviors in dogs aged three, six, nine and 12 months.

The purpose of performance tests is to identify behavioral patterns that may indicate whether dogs are likely to successfully complete dual-purpose K9 training. For example, Gillespie explains, Labradors often work both as service dogs and working dogs. But the profile of each role couldn't be more different; service dogs must be reliable and calm by nature, while working dogs are typically very high-drive.

"They can be hard to manage, but they need to have that over-the-top focus to be successful," she says, adding that while some breeds are more likely to excel in working roles than others, the success of any individual dog depends as much on its temperament and ability to learn as it does on its genetics.

At the Penn Vet Working Dog Center, puppies begin their training at eight weeks of age. They're trained for all potential careers until they "choose" their specialty. That is, until their temperament and behavioral trends show trainers where they're more likely to be successful. Working dogs can be designated as single-purpose, where they are trained to focus on one specific task like scent detection, or they can be slated for a wider range of tasks including detection, rescue and patrolling.

Sit, stay, JMP

While performance testing has many practical uses, Gillespie explains that a more sophisticated statistical analysis of the historical data can add far greater insight that will enable training programs to be more proactive about which dogs they train for which roles. By performing a retrospective behavioral analysis using Penn's archive, she hopes to provide new insight that will improve training outcomes while also keeping costs down for the training center.

"JMP is kind of the perfect middle ground [between SPSS and R]. It has some really unique features but it's also really easy to use. You can keep everything separate and organized."

Jordan Gillespie, PhD student, Auburn University



As with any researcher dealing with complex or messy data sets, Gillespie uses a software program to assist with the statistical heavy lifting. She's chosen JMP®, but not without first considering the other options. Though open source languages like R and Python may have provided an elevated sophistication and flexibility, Gillespie explains that open source wasn't the best option for her, as it would have required her to devote a significant amount of time to learning a programming language. "R can be really difficult to use," she says, acknowledging that the steep learning curve is a trade-off.

"And then you have SPSS, which maybe isn't as innovative and can be a bit cumbersome with all of your outputs in one area. JMP, on the other hand, is kind of the perfect middle ground. It has some really unique features but it's also really easy to use. You can keep everything separate and organized."

Having become familiar with JMP during her undergraduate studies, the software seemed like a logical choice. JMP offers a number of in-built platforms that allow her to easily call up the Penn data set and get to work sorting and analyzing it right away.

Behavioral patterns associated with success

"Ultimately, we're now using JMP to figure out which behavioral trends are indicative of success in different working dog careers," Gillespie says. To prepare her data set, Gillespie evaluates video recordings of performance tests from the Penn Vet Working Dog Center's archive, scoring puppies on environmental soundness and hunt and toy drive at different stages of their training. Whether the puppy successfully completed training in a certain career is also a factor.

Because Gillespie is working with a large amount of data, it's important for her to pare down the data set to meaningful models, and stepwise analysis helps her to determine which variables should be included in any given model. A nominal logistic regression in the Prediction Profiler then allows her to evaluate the influence of variables on working dog

career success. "You find a significant model of behaviors, and then you use JMP Prediction Profiler to put the significant features into the model," Gillespie explains.

She then sets the desirability for a specific working-dog career. "I have the desirability set to 1 - in other words, complete desirability for one career and nothing for others. Basically, I'm asking the tool to determine which features will indicate with near-certainty that a dog will perform well as a dual-purpose police K9."

Of course, the presence or absence of an individual value can't absolutely predict an individual dog's success or failure. "But when you compare all of them, you see the ups and downs of the various behaviors, and you can predict the right career for that dog," Gillespie says.

And she has also worked with a machine-learning-enabled decision tree to identify success-related traits like dog breed. But for her most recent and sophisticated research, "I don't know of a program other than JMP Prediction Profiler that I could do that in," she says.

Scratch and sniff

In the future, Gillespie plans to turn her attention to olfactory stimulation in early development, asking among other things, whether training puppies early amplifies their capacity for olfactory detection and therefore later career success. "Dogs use their noses a lot, but we don't necessarily emphasize that in their early development," she says. "And when they're less than 12 weeks old, they're very impressionable. If we can stimulate those sensory modalities early and make strong connections in the brain during early development, we might be able to impact later cognition and behavior." With any luck, JMP could help make that research a walk in the dog park.

Solution

A researcher at the University of Pennsylvania's Penn Vet Working Dog Center is looking to behavioral analysis for insight by using JMP® to perform a full retrospective analysis of data from training sessions in which durations and frequencies of certain observed behaviors were recorded. With the Prediction Profiler in JMP, she explores the influence of key variables on working dog success.

Results

By using data to identify dogs with the most promise for dual-purpose police K9 work - and do so at an early stage in their development - researchers can reduce the cost of training, accelerate time to success and ensure that dogs are placed in roles at which they can excel.

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